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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/051,228	01/22/2002	Thomas Alan Taylor	CS-21182	7993

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EXAMINER	
SPEER, TIMOTHY M	
ART UNIT	**PAPER NUMBER**
1775	

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Please find below and/or attached an Office communication concerning this application or proceeding.

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
10051228	1/22/2002	TAYLOR ET AL.	CS-21182

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EXAMINER
Timothy M.. Speer

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1775	20070521

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Commissioner for Patents

The attached Supplemental Examiner's Amendment is being sent solely to correct a formal matter. In the section titled "Evidence Relied Upon," the Good, et al., patent number has been changed to read 6,358,002. No other changes to the Examiner's Answer dated 03/19/07 have been made.

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/051,228
Filing Date: January 22, 2002
Appellant(s): TAYLOR ET AL.

Gerald L. Coon
For Appellant

SUPPLEMENTAL EXAMINER'S ANSWER

This is in response to the appeal brief filed December 4, 2006 appealing from the Office action mailed June 1, 2005. This Examiner's Answer replaces the Answer mailed July 5, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

U.S. Patent 5,073,433 to Taylor et al

U.S. Patent 6,432,487 to Graham et al

U.S. Patent 6,358,002 to Good et al

U.S. Patent 5,403,669 to Gupta et al

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 4, 9-13, 17-22, 24-28, 33, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) in view of Graham et al (US 6,432,487). Taylor teaches a 0.003-0.1 inch (0.07-2.5mm) thick thermal barrier coating for a metal substrate and teaches it is ideally suited for substrates such as seals for gas turbine engines (column 4 lines 40-49). The

thermal barrier coating comprises zirconia stabilized with yttria with a density greater than 88% and a plurality of 4-8 mil (0.1-0.2 mm) deep macrocracks homogeneously dispersed (20-200 per linear inch or 50-500 per linear centimeter) throughout the coating to improve its thermal fatigue resistance (column 2 lines 45-49). Taylor does not teach an additional coating thereon that does not include macrocracks. Graham teaches that dense vertically cracked zirconia layers are too dense to abrade and provides an approximately 1.016 inch (0.4mm) sacrificial layer on the dense layer that is easier to remove and serves as an indicator to operators for thickness limits. Both Graham and Taylor teach that the coatings are used in turbine engine components. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide a sacrificial layer such as that of Graham, on the vertically cracked layer of Taylor to provide an indicator during use that the coating is reaching its thickness limits. A chemical composition and its properties are inseparable. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 MPEP 2112.01. Because the prior art exemplifies the applicant's claimed composition in relation to the thermal barrier, the claimed physical properties relating to the thermal shock resistance and the tip to seal wear ratio are inherently present in the prior art. Absent an objective evidentiary showing to the contrary, the addition of the claimed physical property to the claim language fails to provide patentable distinction over the prior art.

Regarding claims 3, 9, 10, 12, 17 and 18, Taylor teaches that horizontal microcracks may also be present, and may be 5-25 % of the average length of the vertical cracks.

Regarding claims 4 and 13, Taylor teaches that the macrocracked layer may be applied by multiple monolayers, each having cracks.

Regarding the number of microcracks, Taylor teaches that there are at least 20 vertical macrocracks per linear inch, which converts to 50 per linear centimeter.

Regarding claims 19-21, while Graham does not teach the density of the outer layer, it is clearly stated that the outer zirconia layer is less dense and is purposefully softer and easier to abrade. It would have been obvious to one of ordinary skill to form the outer layer with a density sufficient to allow increased softness and abradability.

Regarding claim 22, it would have been obvious to one of ordinary skill to provide the layers at a thickness that would provide the desired corrosion resistance to the underlying substrate.

Regarding claim 24, the zirconia may be stabilized by yttria.

Regarding claim 25, Taylor teaches the use of a bond coat between the substrate and the coating.

Claim 27 is considered a method limitation for an article and is not considered to structurally define over the prior art.

Claims 1, 3, 4, 9-13, 17-22, 24-28, 33, and 38 rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) in view of Good et al (US 6,358,002). Taylor teaches a thermal barrier coating for a metal substrate, such as a turbine engine seal. The thermal barrier coating comprises zirconia stabilized with yttria with a density greater than 88% and a plurality of macrocracks homogeneously dispersed throughout the coating to improve its thermal fatigue resistance. Taylor does not teach an additional coating thereon that does not include macrocracks. Good teaches an air seal used in a gas turbine engine comprising a substrate, a dense erosion resistant ceramic layer applied over a bond coat, and an abradable ceramic layer applied over the dense ceramic layer. The dense ceramic layer is applied such that microcracks form in and extend generally through the dense ceramic layer. Good teaches that the abradable coating provides good sealing between the blades and the seals and the underlying layer of dense ceramic material provides

enhanced erosion resistance and durability in addition to the thermal insulating capability of the ceramic material. The abradable material of Good is applied over the portion of the seal that interacts with the rotating turbine blades. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide an abradable material layer such as that taught by Good on a dense cracked ceramic material as taught by Taylor to provide a seal having abradable material only where the seal cooperates with the mating component, good sealing between the blade and the seal, as well as enhanced erosion resistance and durability.

Regarding claims 3, 9, 10, 12, 17 and 18, Taylor teaches that horizontal microcracks may also be present, and may be 5-25 % of the average length of the vertical cracks.

Regarding claims 4 and 13, Taylor teaches that the macrocracked layer may be applied by multiple monolayers, each having cracks.

Regarding the number of microcracks, Taylor teaches that there are at least 20 vertical macrocracks per linear inch, which converts to 50 per linear centimeter.

Regarding claims 19-21, while Good does not teach the density of the outer layer, it is clear that the outer zirconia layer is less dense and is purposefully softer and easier to abrade. It would have been obvious to one of ordinary skill to form the outer layer with a density sufficient to allow increased softness and abradability.

Regarding claim 22, it would have been obvious to one of ordinary skill to provide the layers at a thickness that would provide the desired corrosion resistance to the underlying substrate.

Regarding claim 24, the zirconia may be stabilized by yttria.

Regarding claim 25, Taylor teaches the use of a bond coat between the substrate and the coating.

Claim 27 is considered a method limitation for an article and is not considered to structurally define over the prior art.

Regarding claims 29, 30, 32, 34, 35, and 37 Taylor teaches that the coating may be used for turbine engine seals.

Claim 26 is rejected under U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) and Graham et al (US 6,432,487), as applied to claim 25 above, and further in view of Gupta et al (US 5,403,669). Taylor and Graham as combined above teach a turbine component with a vertically macrocracked layer and a sacrificial layer thereon. As taught by Taylor, a bond coat may be used between the substrate and the coating, but does not address the surface roughness of the bond coat. Gupta teaches a thermal barrier coating of a ceramic on a metal substrate. The ceramic coating may be zirconia, and is attached via a bond coat. The bond coat is applied with a surface roughness of 200-600 microinches, and serves as an anchor for the ceramic coating, which results in an article with resistance to spalling of the coating from underlying portions of the coating system. As it is taught by Gupta that a bond coat with a roughened surface serves to improve the resistance to spalling of the ceramic layer, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a roughened surface to the bond coat of Taylor to improve the spalling resistance of the overlying ceramic layer.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,073,433) and Good et al (US 6,358,002 as applied to claim 25 above, and further in view of Gupta et al (US 5,403,669). Taylor and Good as combined above teach a turbine component with a vertically macrocracked layer and a sacrificial layer thereon. As taught by Taylor, a bond coat may be

used between the substrate and the coating, but does not address the surface roughness of the bond coat. Gupta teaches a thermal barrier coating of a ceramic on a metal substrate. The ceramic coating may be zirconia, and is attached via a bond coat. The bond coat is applied with a surface roughness of 200-600 microinches, and serves as an anchor for the ceramic coating, which results in an article with resistance to spalling of the coating from underlying portions of the coating system. As it is taught by Gupta, that a bond coat with a roughened surface serves to improve the resistance to spalling of the ceramic layer, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a roughened surface to the bond coat of Taylor to improve the spalling resistance of the overlying ceramic layer.

(10) Response to Argument

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

At the outset it is noted that Taylor teaches the specific cracked layer including orientation, length and number of cracks. Taylor also teaches use of the coating in a turbine seal. Taylor does not teach the outer abradable layer applied to the cracked layer. It is the opinion of the examiner that both Graham and Good remedy the deficiencies of Taylor and provide the motivation to do so.

Applicant argues that Graham offers no remedy to the lack of an outer layer of Taylor. Applicant states that Graham is silent with respect to an outer layer that does not include vertical cracks and has a specific wear ratio. As stated previously, Graham teaches a coating for a gas turbine engine component. Graham teaches that dense vertically cracked layers are not suitable

alone for use as in gas turbine engines because the process used to achieve the required characteristics produce a rough surface that is unacceptable. To remedy this, Graham teaches the application of a less dense, easily abradable layer to the layer of dense zirconia. This provides a "fail-safe" indicator so an operator is immediately aware that minimum thickness limits are being approached. From this teaching it is considered obvious to one of ordinary skill to apply the additional layer of Graham to the dense layer of Taylor to provide a "fail-safe" or indicator during use, as well as provide an acceptable surface. Graham's outer layer is porous and not considered to be cracked, as it is clearly taught in contrast to the underlying dense layer. Graham clearly teaches that the underlying dense layer is not suitable and that specific deposition must take place to accomplish the dense layer with cracks, whereas the outer layer is of a different structure than the underlying layer. Graham clearly teaches multiple layers of ceramic with an inner layer having cracks and an outer abradable layer.

Regarding applicant's argument that Graham and Taylor do not provide claimed seal to tip wear ratio and thermal shock resistance, applicant has not addressed how the article would not possess the claimed characteristics, as it clearly is made of similar material and is also structurally similar (a dense yttria stabilized zirconia lower layer with a vertically cracked yttria stabilized upper layer).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed

invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Graham clearly contemplates coating a yttria stabilized zirconia underlayer with an abradable coating for the purpose of using it as a seal. Taylor clearly teaches use of the vertically cracked yttria stabilized zirconia as a seal in a turbine engine.. Furthermore, Graham recognizes that the underlying dense yttria stabilized zirconia layer is not suitable and provides the abradable layer to remedy this problem. These teachings are sufficient to not consider the obviousness rejection one of only hindsight.

Applicant argues that Good offers no remedy to the deficiency of Taylor. Applicant argues that Good does not disclose or suggest vertical segmentation cracks or a multilayer ceramic thermal barrier and abradable coating. As stated previously, Good teaches an air seal used in a gas turbine engine comprising a substrate, a dense erosion resistant ceramic layer applied over a bond coat, and an abradable ceramic layer applied over the dense ceramic layer. The dense ceramic layer is applied such that microcracks form in and extend generally through the dense ceramic layer. Good teaches that the abradable coating provides good sealing between the blades and the seals and the underlying layer of dense ceramic material provides enhanced erosion resistance and durability in addition to the thermal insulating capability of the ceramic material. The abradable material of Good is applied over the portion of the seal that interacts with the rotating turbine blades. It would have been obvious to one of ordinary skill in the art at the time of the invention to provide an abradable material layer such as that taught by Good on a dense cracked ceramic material as taught by Taylor to provide a seal having abradable material only where the seal cooperates with the mating component, good sealing between the blade and the seal, as well as enhanced erosion resistance and

durability. Good clearly teaches a multilayer ceramic thermal barrier, where the lower ceramic layer has cracks and the outer ceramic layer is applied over the portion of the seal that interacts with the turbine blades and is abradable.

Regarding applicant's argument that Good and Taylor do not provide claimed seal to tip wear ratio and thermal shock resistance, Applicant has not addressed how the article would not possess the claimed characteristics, as it clearly is made of similar material and is also structurally similar (a dense yttria stabilized zirconia lower layer with an abradable yttria stabilized upper layer).

In response to applicant's argument again that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Applicant argues that Gupta does not remedy the deficiency of Taylor. Gupta is used in combination with the above rejections over Taylor in view of Graham or Good, to show that a bond coat having sublayers is known in the art and is considered obvious. Gupta teaches a thermal barrier coating of a ceramic on a metal substrate. The ceramic coating may be zirconia, and is attached via a bond coat. The bond coat is applied with a surface roughness of 200-600 microinches, and serves as an anchor for the ceramic coating, which results in an article with resistance to spalling of the coating from underlying portions of the coating system. As it is taught by Gupta, that a bond

coat with a roughened surface serves to improve the resistance to spalling of the ceramic layer, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a roughened surface to the bond coat of Taylor to improve the spalling resistance of the overlying ceramic layer.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Jennifer McNeil SPE 1775
Conferees:

Carol Chaney SPE 1773

Jennifer ~~Keith~~ Michener Appeal Specialist 1700